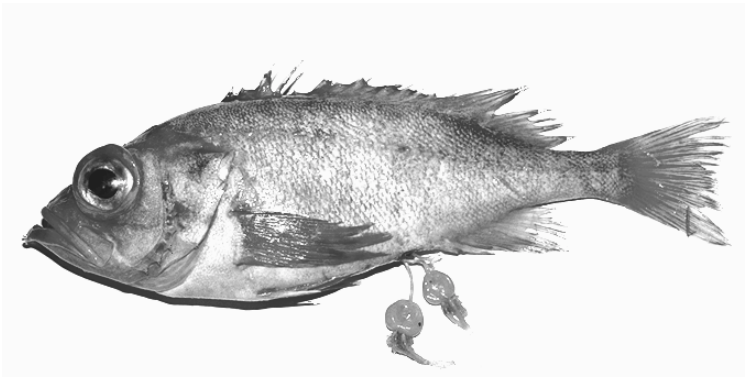
Resource Management Committee **ICES CM 2001/D:04**
Ref: ACFM

REPORT OF THE

PLANNING GROUP ON REDFISH STOCKS

Bergen, Norway
05–06 February 2001



International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

Palægade 2–4 DK–1261 Copenhagen K Denmark

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1 INTRODUCTION

1.1 List of participants

Andrey Pedchenko	Russia
Christoph Stransky	Germany
Eckhard Bethke	Germany
Hajo Rätz	Germany
John Dalen	Norway
Kjell Nedreaas	Norway
Páll Reynisson	Iceland
Þorsteinn Sigurðsson	Iceland (chair)
Torild Johansen	Norway
Victor Mamylov	Russia

Detailed information on participants is given in Appendix I.

1.2 Terms of Reference

At the 88th ICES Statutory Meeting it was decided (C.Res.2000/2D02) that:

"the **Planning Group on Redfish Stocks** [PGRS] (Chair: Mr T. Sigurdsson, Iceland) will meet in Bergen 5-6 February 2001 to:

a) plan an international trawl/acoustic survey of redfish to be carried out in the Irminger Sea and adjacent waters in June/July 2001;

b) prepare work by correspondence during summer/autumn 2001 to report on the outcome of the surveys;

c) consider the required frequency of the surveys as input to assessments.

PGRS will report by 20 February for the attention of the Resource Management Committee and ACFM."

During this meeting, ToR a) and c) were discussed.

2 PLANNING OF THE JOINT INTERNATIONAL SURVEY ON PELAGIC *S.MENTELLA* IN THE IRMINGER SEA AND ADJACENT WATERS IN JUNE/JULY 2001

2.1 Definition of the survey area

The main objective of this survey will be a trawl-acoustic assessment of the pelagic redfish stock in the Irminger Sea and adjacent waters, in June/July, 2001. The basic area coverage was determined to be extended from what has previously been used and was defined in ICES, C.M. 1995 (G:1, Ref.: Assess). As the results from the survey in 1999 indicate that the covered area did not reach the boundary of the distribution area of pelagic redfish in the acoustic layer, the group felt it was necessary to expand the southern area to 52°N and the western boundary to 53°W. As the fishery has also changed towards greater depths during the last years it is also considered important to continue expansion of the vertical coverage to assess the stock which is below the acoustic layer (below 500 m depth; see sections 2.8-2.9). Following research vessels will participate in the survey:

Name of the vessel	Period	Days in field	Country
Bjarni Sæmundsson	19/6-12/7	18	Iceland
G.O. Sars	15/6-11/7	17	Norway
Árni Friðriksson	21/6-12/7	19	Iceland
Atlantniro	10/6-	19	Russia
Walther Herwig III	15/6-12/7	15	Germany

Figure 1 gives the planned cruise tracks. The vessels will communicate daily via telex (Immarsat C), between 0900 and 1200 GMT. Information on the communication among vessels is given in Appendix III.

2.2 Exchange of data during the survey

The daily reporting on the data among the vessels will be performed in the sheet given in Appendix IV. In addition the range of the acoustic values for the last day shall be reported. Information about the data exchange after the survey is given in chapter 2.13.

2.3 Setting of instruments

All participating vessels will use a 38 kHz Simrad EK500 split beam echo sounder and a BI500 post-processor for echo integration.

The standardisation of the setting of instruments was discussed and it was agreed to use an integration threshold of –80 to –84 dB//m3, depending on the pulselength used and the system noise level. It was also agreed that the acoustic data should be stored down to at least 500 m depth. Partners having interest in acoustic data below 500 m will be storing data down to 750 or 1000 m. In Table 1, the settings of instruments are given together with appropriate comments for each vessel.

2.4 Target strength

As the observed length range of the redfish in the 1999 acoustic survey has increased from previous years, a length base target strength formula of **TS=20 lgL-71.3** dB will be used for the estimation of the number of pelagic redfish in the survey area (WD1).

2.5 Survey strategy

In Figure 1 and Table 2, the planned survey tracks are shown for each participating vessel. “Árni Friðriksson” will cover the eastern part of the survey area, "Atlantniro" will cover the area south of Cape Farwell and the central part south to 52°N. "Bjarni Sæmundsson" will cover the area East of Cape Farwell north of 59°30’N and "Walther Herwig III" the southern and western part of the area. The total length of the planned survey tracks is 10760 nautical miles, divided between the vessels as follows:

"Bjarni Sæmundsson" 2445 NM; "Atlantniro" 2913 NM, "Walther Herwig III" 2304 NM and "Árni Friðriksson" 3098 NM.

The Norwegian research vessel, “G.O.Sars” will also participate in the survey, although its cruise tracks are not shown in Figure 1 and Table 2. According to the plans of the EU REDFISH project (QLK5-CT1999-01222), RV “G.O. Sars” will particularly undertake experimental work related to applying the deep towed vehicle system for observing and estimating redfish abundance as well as for carrying out redfish target strength studies for depths greater than 400 m. In certain areas where “G.O. Sars” is working close to one of the other vessels it is agreed that this other vessel may change their echo sounder and BI500 settings to collect and store data of mutual interest for reasons of comparative studies.

In the 1994 and 1996 international surveys, the survey tracks run parallel to lines of latitude with 45 nm. distance between the tracks except for the area of an assumed denser distribution of oceanic redfish, i.e. the so-called "box" where the distance between the tracks was 30 NM. In WD4 to the planning of the 1999 survey (ICES C.M. 1999/G:9), calculations are made on the consequences using only every second track. These results show that a larger distance than 30 NM may be used between the cruise tracks, without seriously affecting the acoustic estimate. Recalculation of the mean acoustic density over the whole survey area covered in the 1994 survey using alternatively the data from every second track, results in estimates which differ by less than 5% from the one obtained using the whole data set. Based on this information it was decided to run the 1999 survey with 45 nautical miles between all cruise tracks, as there was only a limited number of vessels participating and the group felt an urgent need for trawling below 500 m depth. The group decided to do so again in the planned survey 2001, except in the easternmost areas where the distance will be 60 nautical miles.

For evaluating the data, the boundaries of sub-areas A - G as used in the 1994 and 1996 (Magnússon *et al*. 1994 and 1996) surveys will be shifted according to ICES – NAFO regulatory area borders (Appendix V).

2.6 Calibration

At the beginning of each national part of the survey, the calibration of the acoustic equipment on board each vessel will be carried out using a standard sphere calibration (Foote et al. 1987).

The participating vessels will aim at a common inter-ship calibration. Thus, the inter-ship calibration will be carried out between vessels in their overlapping area.

2.7 Acoustic estimation of pelagic redfish

Acoustic data obtained (during the night) when the mixing of the target fish with the components of the deep scattering layer is greatest should be discarded in the biomass estimation. On sections along the survey tracks, where the available acoustic data are not satisfactory due to mixing, the integrator values will be estimated by interpolation (from values in the nearest vicinity).

The acoustic survey data will be divided into statistical rectangles which are 45 minutes in latitude and 1 degree in longitude. A mean value of the area backscattering strength in each rectangle is estimated and subsequently, the number of fish. Values in rectangles which have not been covered but are within the surveyed area are estimated by interpolation from values obtained within rectangles in the nearest vicinity. The total number of fish is then obtained by summation of individual rectangles.

Acoustic data for redfish below 500 m shall be stored separately from the layer 0-500 meters. This shall be done by scrutinising the acoustic data in each depth category as a separate unit in the BI-500 post – processing system.

To be able to make a comparable “detailed report” in the post-processing, the height of the layers should be set to 25 m, and the registrations should be scrutinised and presented for every 5 nautical miles. The data should, however, be stored for every 1 nautical mile. In the acoustic report table (see Appendix VIa), a column for including the upper depth limit of the scattering layer is added.

An effort should be made to estimate the effect of different thresholds at different depths on the integrator values from the acoustic equipment used on the three vessels. This is especially important for the low scattering values expected, as the threshold effect will vary with the pulselength used and may as well be dependent on the resolution of the sv-values stored by the BI500 system (stored depth interval/number of stored values pr ping).

2.8 Abundance estimation of the redfish below the acoustic layer

In addition to the continuation of the acoustic assessment of the oceanic redfish abundance, the second main task of the planned international trawl-acoustic survey is to continue on the attempt to estimate the redfish abundance in and below the acoustic layer. This is due to redfish occurrence and mixing below and with the deep scattering layer of meso-pelagic fishes. The assessment of the redfish abundance inside and below the scattering layer will be attempted by two methods providing absolute estimate (based on the acoustic data) and survey trawl index, respectively.

The catches in number per standardised haul will be converted to expected s_A-values using the linear regression between s_A-values (dependent variable) and catches in number by standardised haul performed (independent variable). This requires the sufficient coverage of the variation in s_A-values and catches between minimum and maximum values. Thereafter, the calculated s_A-values for the depth layer will be converted to absolute fish numbers and fish biomass (Mamylov, WD 3 to ICES C.M. 1999/G9).

The stored s_A-values derived from the deep layer below 500 m will be analysed for their applicability for direct conversion to fish numbers by changing the BI500 threshold settings.

2.9 Trawling

The net used on "Bjarni Sæmundsson" will be a Gloria type #896 with a vertical opening of approximately 47 m. The net employed on “Walther Herwig III“ and on “Árni Friðriksson” will be a Gloria type #1024, with a vertical opening of approximately 50 m. On Atlantniro a Russian pelagic trawl (design 75/448) with a circumference of 448 m and a vertical opening of 47-50 m will be used.

Each vessel should identify the acoustic redfish records by trawl catches in three different types. The identification hauls should exclusively cover:

1. the depth zones less than 500 m, in which redfish could be acoustically identified. The trawling depth may vary at any depth less than 500 m above the deep scattering layer. For abundance estimation in the areas in or below the deep scattering layer, it is essential to integrate the s_A-value over the trawled distance in the trawled depth zones in front of the net at these stations above the deep scattering layer and to report those s_A-values in the specified format (Appendix VIb and X).

2. the depth zone less than 500 m, in which acoustic redfish registration is hampered by the deep scattering layer. Dependent on the actual depth of the deep scattering layer, these identification hauls may cover the following 2 depth layers (headline of the net): 150-300 m, 300-450 m. Trawling distance at each depth layer should be 2 nautical miles calculated with GPS.

3. the depth zones below 500 m depth. The deep identification hauls should cover the following 3 depth layers (headline): 500-650 m, 650-800 m, 800-950 m. Trawling distance at each depth layer should be 2 nautical miles calculated with GPS.

All three types of identification hauls should be evenly distributed in the survey area. Station data as well as total redfish catch in numbers and weight should be reported in accordance with Appendix VI. Changes of course shall also be registered in the sailing diary sheet (Appendix VIb).

2.10 Hydrographical observations

All participants of the international survey will carry out hydrographic observations using CTD down to 1000 m depth. The CTD stations should be taken at the corners of each transection and at each trawl station.

The hydrographical data at 200 m from each CTD station shall be included in daily report for exchange between the participants during the survey.

After the survey, when the data have been calibrated, the whole set of obtained information on pressure, temperature and salinity will be exchanged to each of the participating countries in CTD standard files (Appendix VII).

The long-term hydrographical Russian 3K section (9 standard stations) in the Irminger Sea will be included in the joint survey programme and carried out by the Norwegian research vessel “G.O.Sars” at the beginning of the joint survey.

2.11 Biological sampling

It was agreed to follow a similar procedure as used during the surveys since 1994 (described in ICES C.M. 1993/G:6, ICES CM 1994/G:4 and ICES CM 1999/G:9). The biological data mentioned below shall be exchanged by e-mail, using the database format given in Appendix VI (Excel spreadsheet).

Biological sampling should be conducted as follows:

1. In the case of sub-sampling, the ratio of the sub-sample to the total catch should noted as “conversion factor” in the data recording sheet.

2. Individual data: The total length (cm below), individual weight, sex and stage of maturity should be measured on at least 300 redfish from each haul. The maturity scale given in Appendix VIII will be used for data exchange, whereas the application of the Russian scale (Appendix IX) will be tested during the 2001 survey.

3. Otolith sampling: A minimum of one otolith pair per cm group and sex should be collected at each station. The otolith envelope should carry at least the station no. and fish ID no. given in the database to allow for allocation to the individual biological data.

4. Stomach content and parasite information: Observations on the stomach fullness, the location and size of skin/muscular pigments as well as infestation of *Sphyrion lumpi* and its remnants should be investigated on at least 50 randomly sampled fish from the sub-sample of each haul, according to the details given in Appendix XIc (see

also WD 2 in ICES C.M. 1999/G:9 by Bakay and Karasev). Registration of melanin shall also be recorded on a scale 1-4 (1= nothing, 2= little; 3= medium; 4= much).

Sampling of stomachs for subsequent laboratory analysis is optional. Plankton sampling is also optional.

Genetic and morphological sampling: Samples will be taken on board the Icelandic, German and Norwegian vessels according to the instruction received from the EU-project. It may also be useful to ask the Russian vessel to freeze whole fish for this purpose. Instructions will in that case be sent to the Russian cruise leader by e-mail before the survey.

2.12 Exchange of experts during the survey

All participating nations invited other participants to join in their part of the joint survey.

2.13 Reporting and time frame for the joint report

The reporting will be by correspondence.

As soon as the vessel has finished scrutinising the acoustic data – after the survey tracks are finished, ReportCompactTable must be sent to other participants.

Not later than 1 August, all data shall be sent via email to all cruise leaders. The data shall be sent on the format described in Appendix VI and all participants shall have a copy in an electronic format.

To finalise the report as soon as possible, the participants have decided to divide the work between themselves in following way:

Russia will calculate the abundance estimation of the redfish within (down to 500 m), and below the scattering layer (below 500 m), including writing of the material and methods, results and discussion.

Russia will work up the environmental data, including drawing of pictures, writing of the material and methods, results and discussion.

Iceland will calculate and finalise the acoustic data, including writing of the material and methods, results and discussion. Iceland will also draw the cruise tracks and information on stations.

Germany will be responsible for writing about biological results, including writing of the material and methods, results and discussion.

Norway will give a short report of the towed body experiment.

All drafts must be sent before 25 August 2001 to the chair of the PGRS who will compile the data. The draft report will be sent by the chair to all PGRS participants not later than 10 September for comments and suggestions.

2.14 Considering the required frequency of the surveys as input to assessments

The group decided to comment on this ToR after the survey, in its report from the survey.

2.15 Acknowledgement

Survey tasks are closely coordinated with the EC-funded **REDFISH** project (QLK5-CT1999-01222) granted under the FAIR research program "**Quality of Life and Management of Living Resources, Key Action 5: Sustainable Agriculture, Fisheries and Forestry"**. The participating scientists from Germany, Iceland and Norway express their gratitude to the European Commission for the financial support.

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Magnússon, J., Magnússon, J.V., Sigurðsson, Þ, Reynisson, P., Hammer, C., Bethke, E., Pedchenko, A., Gavrilov, E., Melnikov, S., Antsilerov, M. and Kiseleva, V., 1996. Report on the Joint Icelandic / German / Russian Survey on Oceanic Redfish in the Irminger Sea and Adjacent Waters in June / July 1996. ICES C.M. 1996/G:8.

Magnússon, J., Nedreaas; K. H., Magnússon, J. V., Reynisson, P. and Sigurðsson, Þ., 1994. Report on the joint Icelandic/Norwegian survey on oceanic redfish in the Irminger Sea and adjacent waters, in June/July 1994. ICES C. M. 1994/G:44

Thorsteinn Sigurdsson, Hans-Joachim Rätz; Andrey Pedchenko; Victor Mamylov; John Mortensen, Eckhard Bethke, Christoph Stransky, Hoskuldur Bjornsson, Sergey Melnikov, Yuri Bakay and Konstantin Drevetnyak, 1999. Report on the Joint Icelandic / German / Russian Trawl-Acoustic Survey on Pelagic Redfish in the Irminger Sea and Adjacent Waters in June / July 1999. ICES CM/ACFM:17; Annex to the NWWG report 1999.

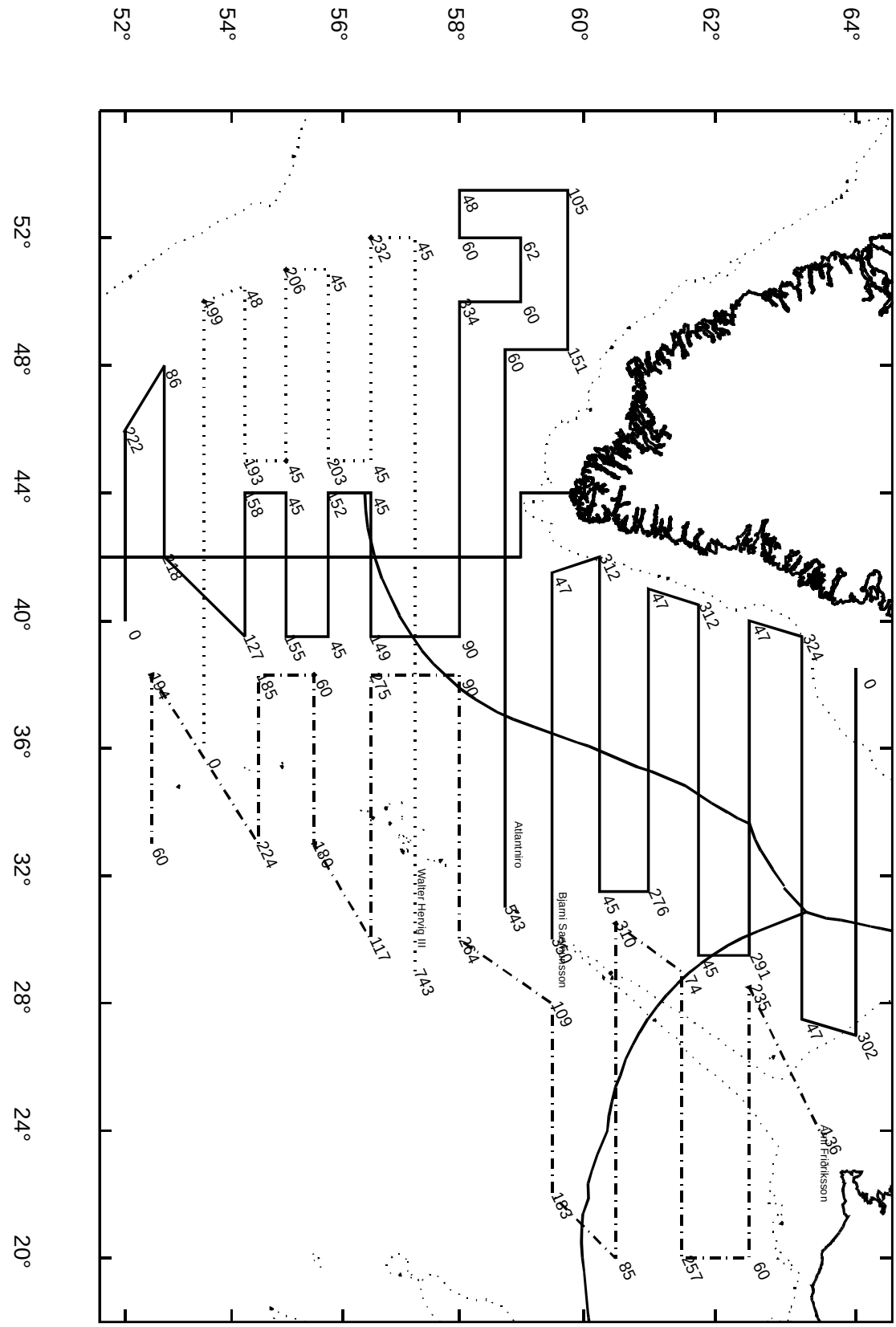

Figure 1. Agreed cruise tracks for the International redfish survey in June/July 2001.

Table 1. Instrument settings of the acoustic equipment settings onboard the participating vessels. On "Bjarni Sæmundsson", "Atlantniro", "Árni Friðriksson" and on "G.O. Sars" the transducers used are hull-mounted, but a towed body will be used on "Walther Herwig III" (towed at about 20 m depth). The sound speed value is approximate for the prevailing hydrographic condition in the survey area.

Vessel	"Bjarni Sæmundsson"	"Atlantniro"	"Árni Friðriksson"	"G.O. Sars"	"Walther Herwig III"
Echo sounder/ integrator	Simrad EK500 /BI500	Simrad EK500 /BI500	Simrad EK500 /BI500	Simrad EK60 /BEI500	Simrad EK500 /BI500
Frequency	38 kHz	38 kHz	38 kHz	multi	38kHz
Transmission power	2000 W	2000 W	2000 W	1000 W	2000 W
Absorption coefficient	10 dB/km	10dB/km	10 dB/km	10 dB/km	10dB/km
Pulselength	1.0 ms	1.0 ms (3.0 ms)	1.0 ms	multi	3.0 ms
Bandwidth	Wide	Wide (Narrow)	Wide	multi	Narrow
Transducer type	ES38-B	ES 38-B	ES38-B	multi	ES38-B
2-way beam angle	-20.6 dB	-21.2	-20.9 dB	multi	-20.9
Integration threshold	-80 dB//m3	-80 dB/m3 (-84)	-80 dB/m3		-80 dB/m3
Sound speed	1470m/s	1470m/s	1470m/s	1470m/s	1470m/s

Table 2. Agreed cruise tracks for the international survey for redfish in June/July 2001.

Bjarni Sæmundsson			**Atlantniro**			**Walther Herwig III**			**Árni Friðriksson**		
Lat	Lon	Distance	Lat	Lon	Distance	Lat	Lon	Distance	Lat	Lon	Distance
-30.00	59.50	Starting	-31.00	58.75	Starting	-29.00	57.25	Starting	-24.00	63.50	Starting
59.50	-41.50	350	58.75	-48.50	543	57.25	-52.00	743	62.50	-28.50	136
60.25	-42.00	47	59.75	-48.50	60	56.50	-52.00	45	62.50	-20.00	235
60.25	-31.50	312	59.75	-53.50	151	56.50	-45.00	232	61.50	-20.00	60
61.00	-31.50	45	58.00	-53.50	105	55.75	-45.00	45	61.50	-29.00	257
61.00	-41.00	276	58.00	-52.00	48	55.75	-51.00	203	60.50	-30.50	74
61.75	-40.50	47	59.00	-52.00	60	55.00	-51.00	45	60.50	-20.00	310
61.75	-29.50	312	59.00	-50.00	62	55.00	-45.00	206	59.50	-22.00	85
62.50	-29.50	45	58.00	-50.00	60	54.25	-45.00	45	59.50	-28.00	183
62.50	-40.00	291	58.00	-39.50	334	54.25	-50.50	193	58.00	-30.00	109
63.25	-39.50	47	56.50	-39.50	90	53.50	-50.00	48	58.00	-38.30	264
63.25	-27.50	324	56.50	-44.00	149	53.50	-36.00	499	56.50	-38.30	90
64.00	-27.00	47	55.75	-44.00	45				56.50	-30.00	275
64.00	-38.50	302	55.75	-39.50	152				55.50	-33.00	117
			55.00	-39.50	45				55.50	-38.30	180
			55.00	-44.00	155				54.50	-38.30	60
			54.25	-44.00	45				54.50	-33.00	185
			54.25	-39.50	158				52.50	-38.30	224
			52.75	-42.00	127				52.50	-33.00	194
			52.75	-48.00	218				51.50	-33.00	60
			52.00	-46.00	86						
			52.00	-40.00	222						
Sum		2445			2913			2304			3098
Days in field		18			19			15			19
Distance per day		136			153			154			163

4 APPENDICES

4.1 Appendix I. List of participants

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4.2 Appendix II. List of Working Documents

Shibanov, V.N., Pedchenko, A.P., Mamylov V.S. and Melnikov, S.P. Russian proposals for conducting the international trawl-acoustic survey for redfish in the Irminger Sea during June-July 2001.

4.3 Appendix III. Information on communication between vessels

R/V Atlantniro (Russia) Call code:UHOB Telephone: 00(871)762-459-744 00(871)762-459-744 Telefax:00(871)762-459-747 Inmarsat C:00(871)427-300-867 GMDSS: email: ki8391@les-raisting.de	**R/V G.O.Sars (Norway)** Call code: LLZG Telephone: +47 91193383/+47 94556811 Telefax: +47 94549900 Telex: 00581 4257 150 10 / 00581 3257 150 14 Inmarsat C: Telephone: 00871 3257 150 10 / 00871 3257 150 11 Inmarsat C:Telefax: 00871 3257 150 12
R/V Bjarni Sæmundsson (Iceland) Call code: TFEA Telephone: +354 8522921/+354 8536847 Telefax:+354 8536847 Inmarsat C: 581425119910	**R/V Walther Herwig III (Germany)** Call code: DBFR Telephone: 00871 1123217 Inmarsat C: +581 42112155 Telefax:+00871 1123221 (also at http://www.inmarsat.org/ships/)
R/V Árni Friðriksson RE 200 (Iceland) Call code: TFNA Telephone: +354 8540535 Telefax:+354 8540532 Inmarsat C: 581 425150710 Inmarsat B (telephone) 00874+325150710 fax 00874+325150711 data 00874+325150712	

4.4 Appendix IV. Sheet used for daily reporting of data among the vessels

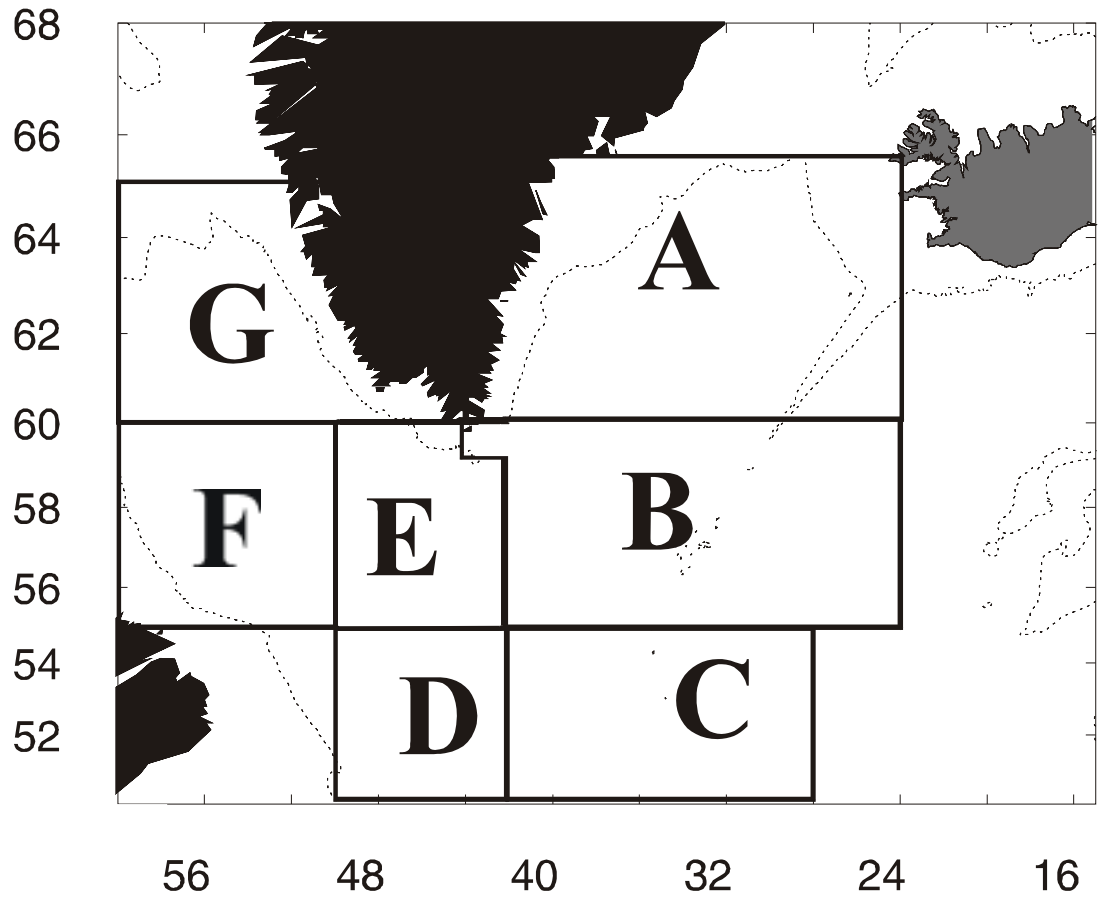
INTERNATIONAL TRAWL-ACOUSTIC REDFISH SURVEY

IRMINGER SEA JUNE-JULY 2001

VESSEL:

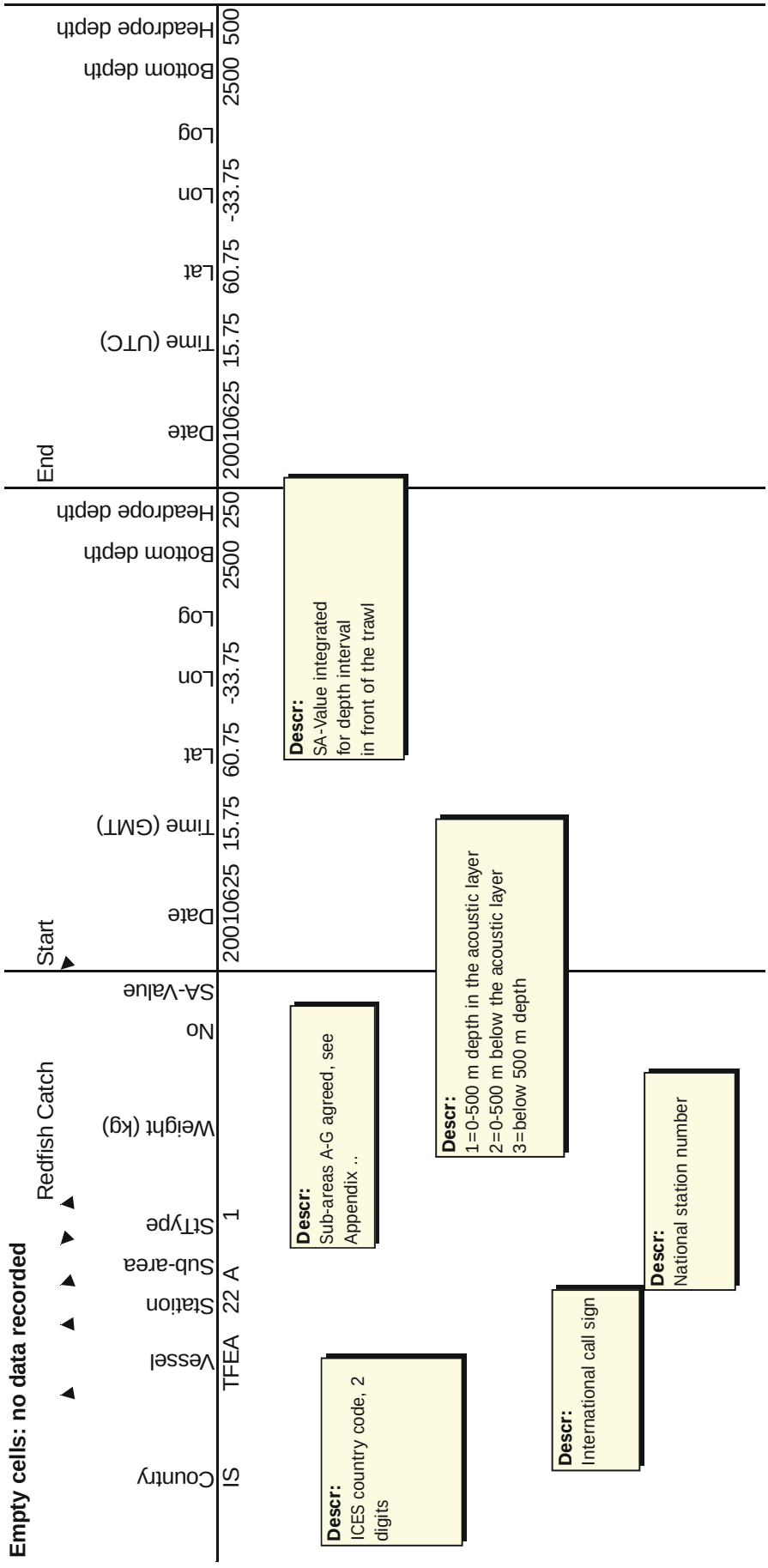
N	Station	Type	Log	Date	Position				Temperature		
	no	of station			Lat.	Lon.		Time (GMT)	at 200 m (°C)	Catch (kg)	Sa range from last

4.5 Appendix V. Sub-areas A-G, agreed to be used in international survey in June/July 2001 for redfish in the Irminger Sea and ajacent waters.

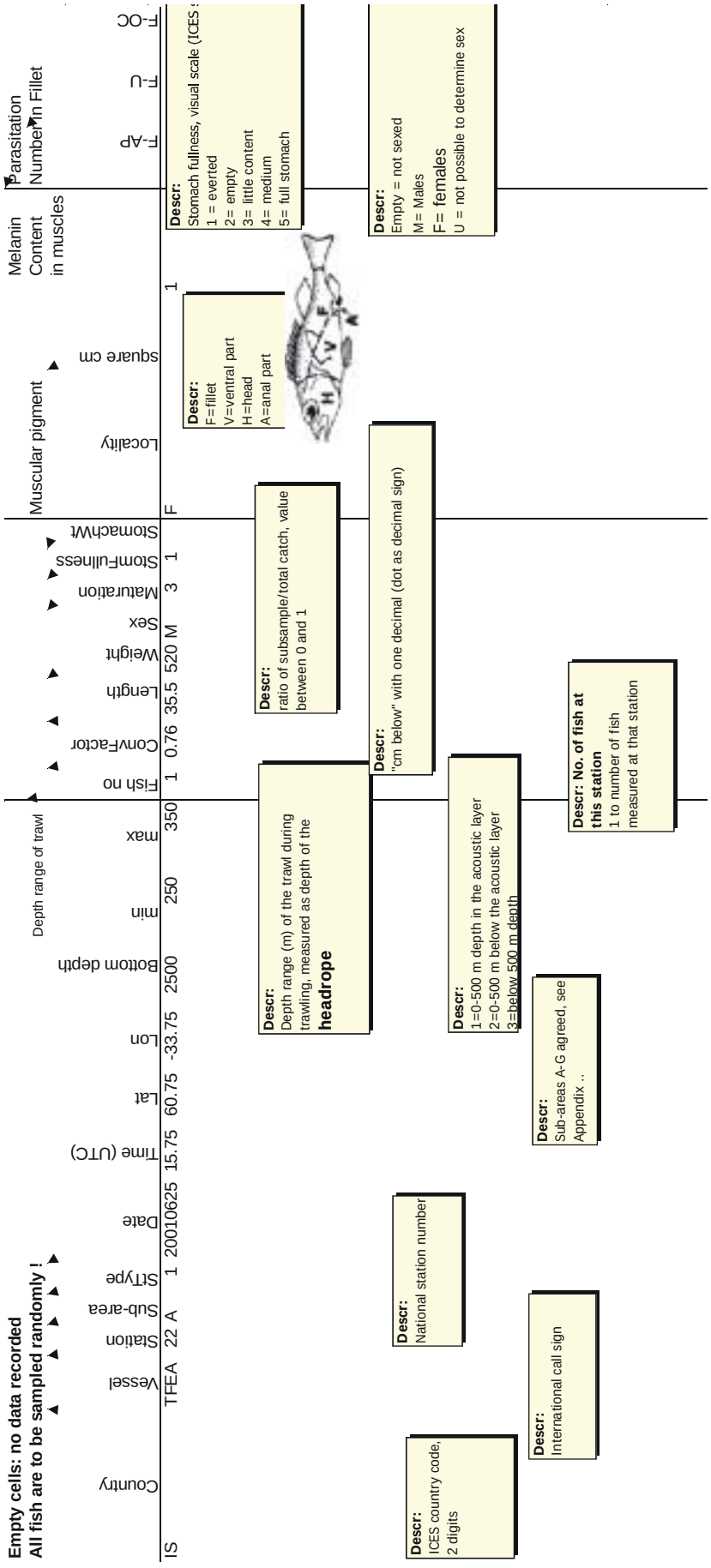


4.6 Appendix VIa. Sheet used for exchange of acoustical observations.

4.7 Appendix VIb. Sheet used for exchange of station information and sailing diary



4.8 Appendix VIc. Sheet used for exchange of biological observations



4.9 Appendix VII. Sheet used for exchange of hydrographical observations.

Form for hydrographic data exchange.
Vessel:
Station no:
Date:
Time:
Lat:
Lon:
Bottom depth:

Pressure	**Temp**	**Salinity**
db	**ITS-90**	**PSS-78**
5.000	2.5595	32.5555

4.10 Appendix VIII. Maturity scale agreed to be used in the international survey in June/July 2001 for redfish in the Irminger Sea and ajacent waters.

STAGE	Description
Stage I (1)	Immature. Ovaries tubular, thin and small. Ovarian wall whitish and delicate. Without conspicuous blood vessels. If visible eggs occur, they are very small, whitish or pale yellowish. Pigmented eye larvae left in the ovary never occur.
Stage M (2)	Maturing/Mature. The ovary has increased in size considerably and it is easy to distinguish in the body cavity. Blood vessels along the ovary wall can be observed and the eggs are clearly visible inside the ovary. Eggs are yellow and opaque.
Stage F (3)	Mature/Fertilized. Ovaries are considerably bigger and occupy most of the body cavity. The colour is bright yellow. Many eggs are transparent (approx. 50%) because of yolk reabsorption and the eye pigment of the larvae becomes visible.
Stage P (4)	Parturition. The ovary occupies practically the whole body cavity, it is delicate and the wall transparent and thin. The colour shifts to a green-yellowish due to larval developing, the eyes are evident and there is little yolk. Larvae are easily released from the ovary when it is manipulated.
Stage S (5)	Postspawning. Ovary is flaccid, but still big. No visible larvae inside or just remains of them. The colour is purple or blackish, sometimes confused with the body cavity wall (peritoneum).
Stage R (6)	Recovery. Size is reduced to stage F or smaller, but no visible eggs, colour yellow to purple.

4.11 Appendix IX. Russian maturity scale.

	MALES
Juvenile stage	Gonads are poorly developed, sex is indistinguishable. Specimens at this stage occur throughout a year.
Stage 1	Sex is distinguishable. Testicles are as thin long colourless bends and occur throughout a year.
Stage 2	Testicles are as thick long bends, on a cross section they are of irregular triangular shape of brownish colouring. Remnants of non-extruded sperm are available in repetitive-maturing specimens. December-March.
Stage 3	Testicles are large, elastic, coloured brown, in some cases they are of violet shade. Along a cross section they are of triangular shape with smoothed angles. March-June.
Stage 4	Testicles are large, of light-brown colouring, with a white colour being irregular in some areas. At the end of the stage the testicles are white due to the sperm formed. Along the cross section the sperm does not run. June-September.
Stage 5	Mating period. Testicles are of milky-white colour. When dissecting the external sides flow down and drops of sperm are released from spermatic duct. September-November.
Stage 6	Extrusion (after mating).Testicles are of brownish colour with white patches. Two zones are visible along a cross section, i.e. brown marginal and white middle zones. October-December.
	FEMALES
Juvenile stage	Gonads are poorly developed, sex is indistinguishable. Specimens at this stage occur all the year round.
Stage 1	Ovaries are poorly developed, of light-yellowish colour, eggs are indistinguishable during a whole year.
Stage 2	(for repetitive-spawning fish - stage 9-2). Eggs are with 0.2-0.5mm diameter. In immature fish a membrane of ovaries is transparent, in repetitive-spawning specimens it is covered with black pigment. May-August.
Stage 3	Ovaries are bright-orange, egg diameter is about 1mm. August-September.
Stage 4	Ovaries occupy above a half of the body cavity, egg diameter is up to 1.5mm. September-December.
Stage 5	Ovaries are muddy-greenish, eggs are transparent. December-March.
Stage 6	Ovary membrane is strongly prolonged. The stage lasts from the moment of cleavage to the beginning of eye pigmentation in embryo. December-March.
Stage 7	Eye pigmentation begins in embryos owing to which ovaries gradually acquire black colouring. February-March.
Stage 8	Eyes acquire bright metallic shade. Embryos are well developed and mobile. The stage lasts until larvae extrusion.
Stage 9	Ovaries have fallen off, of bloody colouring. Single unextruded larvae occur. April-June.

4.12 Appendix X. Sheet used for registration of acoustic values of redfish during trawling at depths above 500 m (optional).

			S_A values for redfish at the same location as the trawl haul							
Station No.	Depth of trawl (m)	Vertical opening	Inside the trawl opening	0-150 m	150-300 m	300-450 m	450-600 m	600-750 m	> 750 m	Comments